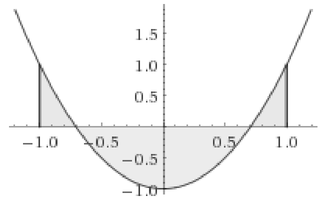
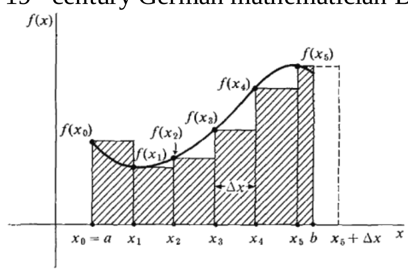
7. Kate

Program Name: Kate.java **Input File: kate.dat**

Kate is taking her first calculus class and is very excited to learn about integration. She understands this process takes a function and finds the area that the graph of this function makes with the x-axis. For example, the diagram below shows the integral of the function $y = 2x^2-1$, with a y-axis range from –1 to 1, and a final integral value of -0.67. She asks why the answer is negative, thinking that area cannot be negative, and is answered by her teacher Ms. Sno that a negative result means that in this case, most of the area of the curve bounded by the x axis is below that axis, which made sense to her.



Ms. Sno went on to explain that integrals, when done by a computer, have to be done in a particular way; in other words, the space has to be "discretized". This means separating the x-axis into small pieces. In this process, the function is evaluated at every point, and a rectangle of the height of the function and the width of the discretion size is created. These rectangles are summed to represent the approximate value of the integral. This technique is often called a Riemann sum, named after the 19th century German mathematician Bernhard Riemann.



Kate needs your help in writing a program that simulates an integral calculator using this method. Given a function, a lower bound, an upper bound, and a discretation size, find the approximate integral value. To find the integral, start at the lower bound, and create rectangles of width equal to the discretation size and height equal to the function value evaluated at that point.

Input: The first line, N, will be the number of data sets to follow. Each data set has two lines. The first line is the equation. The equation is always a polynomial. The second line contains 3 doubles. The first double is the lower bound of the integral evaluation. The second is the upper bound of the integral evaluation. The last is the discretation size for dividing the x-axis. *Note: the given discretation size is guaranteed to always divide evenly along the distance between the upper bound and lower bound.*

Output: For each data set, output the integral value, formatted to 2 decimal places.

Sample input:
```
3
1.0x^5 + 2.2x^3 + 3.23x^4 + 4 - 3.2x
-1.4 1.6 0.1
9.323x^3 - 9x + 3
1 2 0.5
2x^2 - 1
-1 1 0.001
```

Sample output:
```
22.91
12.14
-0.67
```